As discussed below, another Declaration by Dr. Fedynyshyn is herein enclosed that provides objective evidence, in the form of experimental results, indicating that the compositions of Kawamura do not exhibit minimum base solubility required for their use as either a positive or a negative resist. Hence, claim 1 and claims 6-17 distinguish patentably over Kawamura.

More particularly, claim 1, as amended, recites a positive photosensitive resist composition that includes a resin binder and an encapsulated inorganic material having core particles with an average size that is less than about 10 nanometers. Claim 1 further recites that the photoresist is sufficiently base soluble upon activation by radiation to function as a positive resist.

The Kawamura reference has been cited by Examiner for its disclosure of photosensitive polymeric materials having encapsulated inorganic particles. As discussed in detail in the response to the previous Office Action, Kawamura does not relate to positive photoresist compositions, but rather describes a printing plate having a support on which a photosensitive layer is formed. The photosensitive layer can be selectively exposed to heat and/or radiation to form a porous three-dimensional structure that is highly cross-linked. The cross-linked areas become hydrophilic and hence can be moistened with water so as to reject lithographic ink whereas the unexposed hydrophobic areas can accept lithographic ink for printing purposes.

Unlike the claimed photoresists of the invention, the compositions of Kawamura do not exhibit minimum base solubility required for their use as photoresists. The enclosed Declaration of Dr. Fedynyshyn corroborates this assertion by providing experimental measurements of base solubility performed for a resist formulation described in kawamura. In particular, resists based on a formulation of Kawamura described in col. 31 of Kawamura's patent, and noted in Dr. Fedynyshyn's previous Declaration, were prepared and their base solubility was measured. Each resist's base solubility was measured in the following manner. The resist was spin cast as a film on a silicon wafer followed by a post application bake (PAB). The film's thickness before development with a base developer solution was compared with the film's thickness after development with the base developer to assess the resist's base solubility.

By way of background, typical conditions for developing a resist film includes immersing the film in a base developer solution for about 30 to 60 seconds. Upon development, a positive resist exhibits essentially 100 percent dissolution in the portions exposed to actinic radiation while a negative resist exhibits essentially 100 percent dissolution in its unexposed portions.

As the attached Declaration indicates, the resists tested by Dr. Fedynyshyn did *not* exhibit a minimum base solubility required for their use either as a positive or a negative resist. For example, the resist referred to as Resist A in the Declaration retained approximately 85 percent of its thickness in the areas exposed to 96 mJ/cm^2, and the resist referred to as Resist B in the Declaration retained approximately 90 percent of its thickness in the areas exposed to about 96 mJ/cm^2 of radiation, after a development step that included immersion in an aqueous base developer solution for about 60 seconds. Thus, neither Resist A nor Resist B can be utilized as a positive resist.

Hence, Kawamura's formulations are not sufficiently base soluble to function either as a positive or a negative photoresist.

Accordingly, claim 1 distinguishes patentably over the teachings of Kawamura. Claims 7-14 depend on claim 1, and hence are also patentable over the teachings of Kawamura.

Independent claim 15, as amended, recites a positive photosensitive resist composition that includes a resin binder and an encapsulated inorganic material containing core particles having an average size ranging from about 1 nm to about 50 nm. The claimed photoresist is sufficiently base soluble upon activation by radiation to function as a positive resist.

The remarks provided above in connection with claim 1 apply with equal force to establish that claim 15 is likewise patentable over kawamura. Further, claim 16 depends on claim 17, and hence is also patentable.

CONCLUSION

In view of the above amendments and remarks, Applicant respectfully requests reconsideration and allowance of the application. Applicant invites the Examiner to call the undersigned at (617-439-2514) if there are any remaining issues.

The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment, to Deposit Account No.: 141449, Order No.: 101328-148.

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Respectfully submitted,

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List of All Pending Claims

1. (Currently Amended) A positive photosensitive resist composition comprising a resin binder and an encapsulated inorganic material comprising core particles having an average size less than about 10 nanometer, wherein the photoresist is sufficiently base soluble upon activation by radiation to function as a positive resist.

2. (Original) The positive photosensitive resist composition of claim 1, wherein the binder is a t-butyl blocked polyvinyl phenol.

3. (Original) The positive photosensitive resist composition of claim 1, wherein the binder is a polyvinylphenol and t-butyl acrylate copolymer.

4. (Original) The positive photosensitive resist composition of claim 1, wherein the binder is a polyvinylphenol, t-butyl acrylate and styrene terpolymer.

5. (Original) The positive photosensitive resist composition of claim 1, wherein the binder is a DNQ novalak binder.

6. (Original) The positive photosensitive resist composition of claim 1, wherein the encapsulated inorganic material is silicon dioxide.

7. (Original) The positive photosensitive resist composition of claim 1, wherein the encapsulated inorganic material is aluminum oxide.

8. (Original) The positive photosensitive resist composition of claim 1, wherein the encapsulated inorganic material is titanium oxide.

9. (Original) The positive photosensitive resist composition of claim 1, wherein the content of the encapsulated inorganic resist material is between about 0.1% and about 90% by weight of the positive photosensitive resist composition.

10. (Original) The positive photosensitive resist composition of claim 1, wherein the content of the encapsulated inorganic material is between about 5% and about 75% by weight of the positive photosensitive resist composition.

11. (Original) The positive photosensitive resist composition of claim 1, wherein the content of the encapsulated inorganic material is between about 20% and about 50% by weight of the positive photosensitive resist composition.

12. (Original) The positive photosensitive resist composition of claim 1, wherein the binder and the encapsulated inorganic material form a clear positive photosensitive resist composition.

13. (Original) The positive photosensitive resist composition of claim 1, further comprising a surfactant.

14. (Original) The positive photosensitive resist composition of claim 1, further comprising a solvent.

15. (Currently Amended) A positive photosensitive resist composition comprising a resin binder and an encapsulated inorganic material comprising core particles having an average size ranging from about 1 nm to about 50 nm, wherein the photoresist is sufficiently base soluble upon activation by radiation to function as a positive resist.

16. (Original) The positive photoresist composition of claim 15, wherein the average size of the particles ranges from about 1 to about 20 nm.

17. (Original) The positive photoresist composition of claim 1, wherein the encapsulated inorganic material further comprises core particles having an average size less than about 5 nm.